ANNUAL REPORT 1965

KITCHENER

water pollution control plant

DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Kitchener Local Advisory Committee,
City of Kitchener.

Gentlemen:

I am pleased to provide you with the 1965 Annual Report for the Kitchener Water Pollution Control Plant, OWRC Project No. 58-S-19.

We appreciate the co-operation you have extended to our Operations staff throughout the year, and trust that continuation of this close association will ensure even greater progress in the sphere of water pollution control.

Yours very truly,

D. S. Caverly,
General Manager.

ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET

TORONTO 5

J. A. VANCE, LL.D.
CHAIRMAN

J. H. H. ROOT, M.P.P.
VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MacDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am pleased to provide you with the 1965 Annual Report on the operation of the Kitchener Water Pollution Control Plant, OWRC Project No. 58-S-19.

The report presents design data, outlines operating problems encountered during the year and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report provides useful information on the operating efficiency of this project during 1965. It is intended to act as a guide in gauging plant performance. To implement that aim, it includes detailed statistical and cost data, a description of the project and a summary of its operation during the year.

Of particular interest will be the cost data, which show the total cost to the municipality and the areas of major expenditure.

The Regional Operations Engineer is primarily responsible for the preparation of the report, and has compiled and arranged the material. He will be pleased to answer any questions regarding it. Other groups, however, were involved in the production, and these include the statistics section, the Drafting Section of the Division of Sanitary Engineering and the Division of Finance.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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KITCHENER
water pollution control plant

operated for

THE CITY OF KITCHENER

by the

ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN: Dr. James A. Vance

VICE-CHAIRMAN: J. H. H. Root, M.P.P.

COMMISSIONERS

W. D. Conklin, Q.C.
D. A. Moodie
H. E. Brown
L. E. Venchiarutti

GENERAL MANAGER: D. S. Caverly

ASSISTANT GENERAL MANAGERS

L. E. Owers
F. A. Voege
K. H. Sharpe
A. K. Watt

COMMISSION SECRETARY

W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: D. A. McTavish
Operations Engineer: B. W. Hansler

801 Bay Street Toronto 5

'65 REVIEW

A total of 3,328.10 million gallons of sewage was treated at the Kitchener Water Pollution Control Plant during the year at a total cost of $225,144.17. The operating cost per million gallons and the cost per pound of BOD removed were $67.75 and $0.02 respectively.

The average daily flow of 9.1 million gallons was 9.6 percent greater than last years figure of 8.3 million gallons. The average suspended solids increased from 394 ppm in 1964 to 417 ppm in 1965 and the average BOD decreased from 451 ppm in 1964 to 320 ppm in 1965. The average effluent BOD and suspended solids concentrations of 38 ppm and 42 ppm respectively exceeded the OWRC objectives of 15 ppm for each. The average BOD and suspended solids removal efficiencies were 88 percent and 90 percent respectively.

Digester operation improved in 1965. The volatile matter was reduced by an average of 47.7 percent as compared to an average of 35.2 percent in 1964.

Under the supervision of head office engineers, the plant staff has operated a clean, attractive and efficient plant for the City of Kitchener.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1956 - 1964

INCEPTION

In 1956, the City of Kitchener and the Ontario Water Resources Commission initiated plans to enlarge the existing Doon Valley Sewage Treatment Plant and replace the existing Spring Valley plant with a pumping station to discharge sewage from that area to the Doon plant. The enlargement of the Doon plant and the addition of secondary sections to provide full biological treatment was undertaken in two stages.

The firm of Proctor & Redfern, Toronto, Ontario, Consulting Engineers, was engaged to prepare plans and specifications for the project.

APPROVAL

The initial agreement between the City and the Commission to finance, construct and operate the plant was signed late in 1956.

CONSTRUCTION

Construction of the Doon plant extensions, Spring Valley pumping station and force main and relief sewer was carried out by Schwenger Construction Co. Ltd., Harry Wunder Construction Ltd. and Ture Anderson Construction Ltd., respectively. The primary enlargement was completed in 1960.

Secondary treatment facilities were completed in 1963 by Dunker Construction Co. Ltd., Kitchener.

TOTAL COST

Doon Primary plant enlargements	$ 1,312,746
Secondary treatment facilities	$ 1,588,608

Project Staff

L. R. Edwards

Superintendent

Chief Operator - F. D. Angus

Lead Operators

J. H. Bowie
F. Dobson
P. W. Kuehl
G. L. Lebegut
A. H. Schlueter

Laboratory Technician

K. Sakamoto

Groundskeepers

D. J. Oland
J. LaFlamme

Maintenance Staff

Foreman - W. W. Reinhart
Electrician - L. B. Brown
Mechanic - Z. V. Etmanski

Operators

J. J. Halley
A. Nielson
J. P. O'Reilly
W. G. Pohl
E. R. Wheeler

COMMENTS

The plant is staffed 24 hours per day, seven days per week. Each man works a 40-hour week and the total staff complement is 18 men.

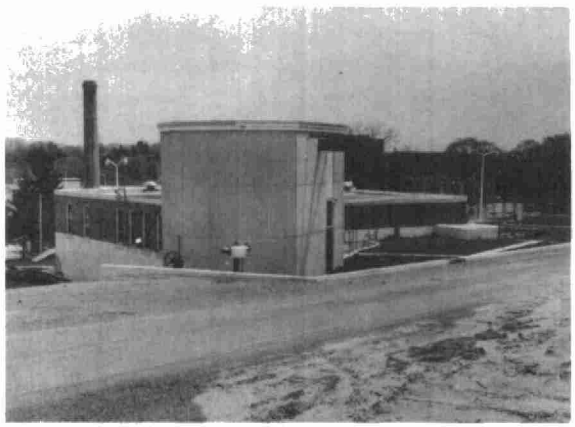
L. Edwards was promoted on January 1, 1965, from Assistant Superintendent to Superintendent replacing A. W. Becker. Mr. Becker retired on December 31, 1965 after a lengthy illness.

Mr. F. D. Angus transferred from Galt WPCP on May 10, 1965 to commence duties as a Chief Operator. The Chief Operators' responsibilities were mainly concerned with the process operational section of the WPCP.

Mr. E. R. Wheeler resigned on July 1, 1965 due to ill health. His position was filled with the promotion of Mr. D. J. Oland, from groundskeeper.

Messrs. Angus, Etmanski and Lebegut attended sewage works operator courses in 1965. Two one week duration courses per year are held in Toronto sponsored by the OWRC. After successful completion of the three available courses, applicants receive a Certificate of Qualification as Sewage Works Operators.

Description of Project



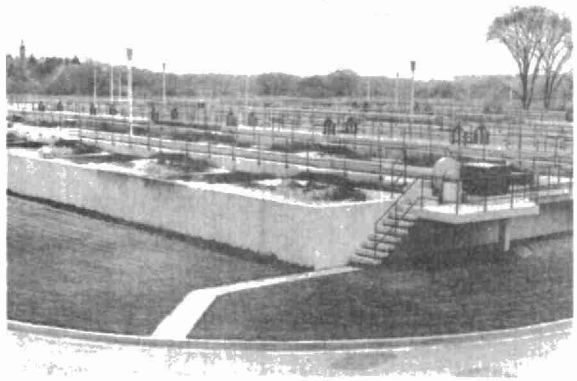
INFLUENT WORKS

The sewage reaches the plant through a 48 inch diameter trunk main and passes through a coarse bar screen which removes large (over two inches) solids. The flow then passes through two rotogrators and one comminutor which are mechanically cleaned medium bar screens equipped with a shredding drum to cut the screenings and allow them to join the main flow. The sewage then passes through a 3 foot Parshall flume where the flow is measured, indicated and recorded. The flow is then divided between two aerated grit chambers. Sand and gritare removed and air lifted to a hopper to be disposed by burial. The air degrittors have a total volume of 23,000 gallons and provide a retention time of three minutes at design flow. Two mesh rotary screens receive sewage from the grit removal units. These screens are designed to remove hair and other matted material.

PRIMARY CLARIFIERS

A grease separator is located on each side of the grit building and sewage passes through these units where large quantities of bubbled air cause the grease to rise in the form of grease balls. The grease balls are removed manually prior to primary clarification.

Four concrete tanks, 60 ft. x 60 ft. x 11.75 ft. SWD provide primary clarification. Each clarifier is provided with circular extensible sludge collector mechanisms which move the settled sludge to hoppers at the bottom of the clarifiers from where it is withdrawn and discharged to the primary digestion tanks. Circular extensible scum removal mechanisms skim floating material from the top of each clarifier. This material joins the sludge in the digesters.



AERATION

Primary clarifier effluent flows through a 48 inch Parshall flume and overflow chamber to four baffled aeration tanks each equipped with fourteen Ames Crosta "Simplex" high intensity mechanical aeration devices. The tanks, continually seeded with activated sludge settled in the final tanks, provide the environment

where, through biological action, the finely divided, suspended and colloidal materials are oxidized.

FINAL CLARIFIERS

Four 80 ft. diameter circular concrete final tanks with 10 ft. liquid depth received the aeration effluent and allow settling of the activated sludge. The clarifiers are the rapid sludge removal type wherein the return sludge is removed hydraulically to a centre launder via plastic uptake pipes mounted on the scraper arms. The waste sludge is scraped to a central sump in the conventional manner from where it is pumped to the incoming raw sewage flow prior to primary clarification. The settled effluent is discharged over weirs to the chlorine contact chamber and subsequently to the Grand River.

SLUDGE DIGESTION TANKS

Two underground primary digesters 65 ft. in diameter x 22 ft. SWD and having a total volume of 900,000 gallons received combined raw and waste activated sludge from the primary clarifiers. These tanks have fixed concrete roofs supported by a structural steel bridge. Sludge to the digesters is measured by a magnetic flow meter. Each digester is equipped with a draft tube mixer and is heated with Rayscott hot water boilers and spiral heat exchangers. The temperature in the digesters is controlled by the amount of sludge recirculation through the heat exchangers. The initial stages of anaerobic digestion occurs in these primary digesters.

Two secondary digesters 100 ft. in diameter and having a 29 ft. mean liquid level, were constructed in 1959. The total secondary digestion volume is 2 1/2 million gallons. Floating covers and gas collection equipment are provided with these tanks. The final stages of anaerobic digestion and settling of the digested sludge occurs in these unheated tanks.

VACUUM FILTER

Digested sludge from the secondary digester is pumped onto a 500 sq. ft. vacuum filter. Lime and ferric chloride are added to the sludge to affect coagulation.

The filter drum is placed under a vacuum and moisture is withdrawn from the sludge. Appurtenances included with the filter are vacuum pumps, filtrate return pumps, lime and ferric chloride pumps, a mixing tank and sludge pumps. Filtrate flows by gravity to a filter sump. From there it is pumped to the influent works just above the air degrittor.

PROJECT COSTS

STAGE I

NET CAPITAL COST (Final) Long Term Debt to OWRC	$1,312,746.07
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1965	$ 316,949.34
Net Operating	$ 225,144.17
Debt Retirement	47,626.00
Reserve	9,000.76
Interest Charged	73,654.25
TOTAL	$ 355,425.18

RESERVE ACCOUNT

Balance at January 1, 1965	$ 56,892.69
Deposited by Municipality	9,000.76
Interest Earned	3,341.05
	$ 69,234.50
Less Expenditures	-
Balance at December 31, 1965	$ 69,234.50

STAGE II

NET CAPITAL COST (Estimated)	$1,588,607.70
DEDUCT - Portion Financed by CMHC (Final)	1,016,967.77
Long Term Debt to OWRC	$ 571,639.93
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1965	$ 46,341.46

Net Operating	$ NIL
Debt Retirement	20,710.00
Reserve	10,712.12
Interest Charged	26,674.98
TOTAL	$ 58,097.10

RESERVE ACCOUNT

Balance at January 1, 1965	$ 15,306.88
Deposited by Municipality	10,712.12
Interest Earned	1,076.70
	$ 27,095.70
Less Expenditures	-
Balance at December 31, 1965	$ 27,095.70

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER
JAN	7967.36	5795.90	283.76			947.30	214.64	16.23	632.27	77.26	
FEB	18103.66	5799.07	303.01		2574.59	2845.49	8.36	56.78	3664.45	2851.91	
MARCH	16129.41	7029.92	255.44		2852.15	4169.05	466.75	239.86	957.12	158.12	
APRIL	21056.58	7332.44	141.88		2500.54	5633.01	1121.20	16.38	1099.55	3191.58	
MAY	25861.05	10262.18	361.10	324.48	2432.51	3356.81	467.52	1636.17	827.09	6153.14	40.05
JUNE	20176.14	6682.51	790.28		2249.45	4220.45	448.75	266.76	1550.05	3967.89	
JULY	15913.38	6583.46	784.91		2327.14	4154.13	307.86	1244.01	372.51	139.36	
AUG	21095.26	6376.54	1268.70		2262.14	1900.16	488.51	197.41	691.68	7910.12	
SEPT	16394.16	6696.97	873.67		2350.48	3679.14	619.10	156.56	686.91	1230.80	100.53
OCT	18371.14	10036.72	1302.70		2410.15	3008.75	220.51	458.93	842.03	91.35	
NOV	18976.70	7277.13	555.50		2344.84	2816.32	400.50	13.34	2432.73	3136.34	
DEC	25099.33	6785.21	465.82		2886.86	9510.68	691.10	473.98	1239.70	3007.28	38.70
TOTAL	225144.17	86658.05	7386.77	324.48	27190.85	46261.29	5454.80	4776.41	14996.09	31916.15	179.28

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $18,850.21
BRACKETS INDICATE CREDIT

YEARLY COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	2649.60	$ 118,269.	* $ 5.73	$ 50.30	3.8 CENTS
1962	3254.55	100,007.	4.88	30.72	2.4 CENTS
1963	2841.14	137,547.	6.82	49.46	2.8 CENTS
** 1964	3026.52	217,425.	10.57	71.84	1.7 CENTS
1965	3328.10	225,144.	10.61	67.65	2 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY
** AERATION PORTION OF PLANT PLACED IN OPERATION

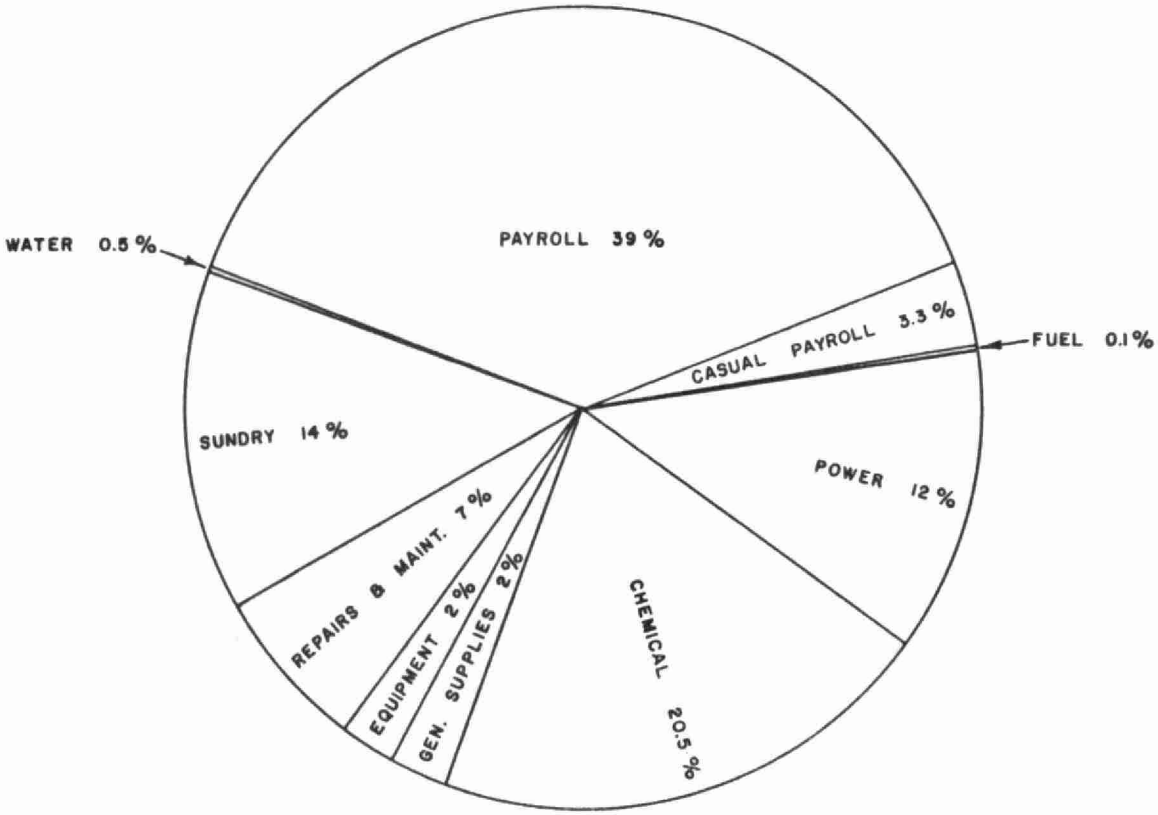
VACUUM FILTER COSTS (MONTHLY)

Month	Cost Per Month						Cost Per Ton Dry Weight					
	FeCl3	Lime	Labour	Elec	Maint	Total	FeCl3	Lime	Labour	Elec	Maint	Total
January	1846.82	1217.24	706.16	233.43	84.66	4088.31	8.07	5.32	3.08	1.02	0.37	17.86
February	1410.42	935.66	706.16	173.45	84.66	3310.35	8.29	5.50	4.15	1.02	0.50	19.46
March	2192.97	1216.78	706.16	267.19	84.66	4467.76	8.37	4.65	2.70	1.02	0.32	17.06
April	1814.11	1238.01	706.16	297.79	84.66	4140.73	6.21	4.24	2.42	1.02	0.29	14.18
May	2457.77	1099.07	706.17	329.00	84.66	4676.67	7.62	3.41	2.19	1.02	0.26	14.50
June	2244.02	1244.01	706.17	307.22	84.66	4586.08	7.45	4.13	2.34	1.02	0.28	15.22
July	1777.66	1101.84	706.17	228.33	84.66	3898.66	7.94	4.92	3.15	1.02	0.38	17.41
August	2158.36	1256.94	706.17	247.81	84.66	4453.94	8.88	5.17	2.91	1.02	0.35	18.33
September	2137.49	1291.10	706.17	254.80	84.66	4474.22	8.56	5.17	2.83	1.02	0.34	17.92
October	1910.27	1183.54	706.17	268.52	84.66	4153.16	7.26	4.50	2.68	1.02	0.32	15.78
November	1869.17	1211.70	706.17	296.31	84.66	4168.01	6.43	4.17	2.43	1.02	0.29	14.34
December	1821.86	1223.70	706.17	282.80	84.66	4119.19	6.57	4.41	2.55	1.02	0.31	14.86
Total	23640.92	14219.59	8474.00	3186.65	1015.92	50537.08						
Average Per Month	1970.08	1184.97	706.17	265.56	84.66	4211.42	7.64	4.63	2.79	1.02	0.33	16.41

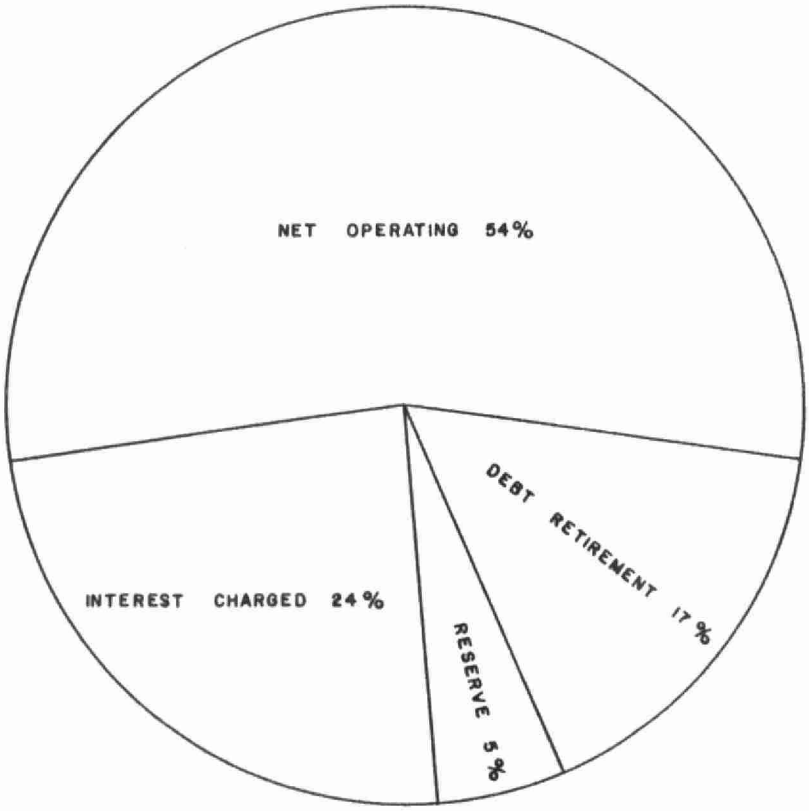
COMMENTS

Vacuum filtration operation during 1965 cost $50,537.08 or $16.41 per ton of dry solids filtered. In comparison to 1964, the substantial increase in total operating costs is due to the increase in solids filtered. The filter was not in operation during May, June and July 1964 when the secondary digesters were drained and cleaned. In addition, increased loading on the WPCP in 1965 accounted for an increased volume of solids that were filtered.

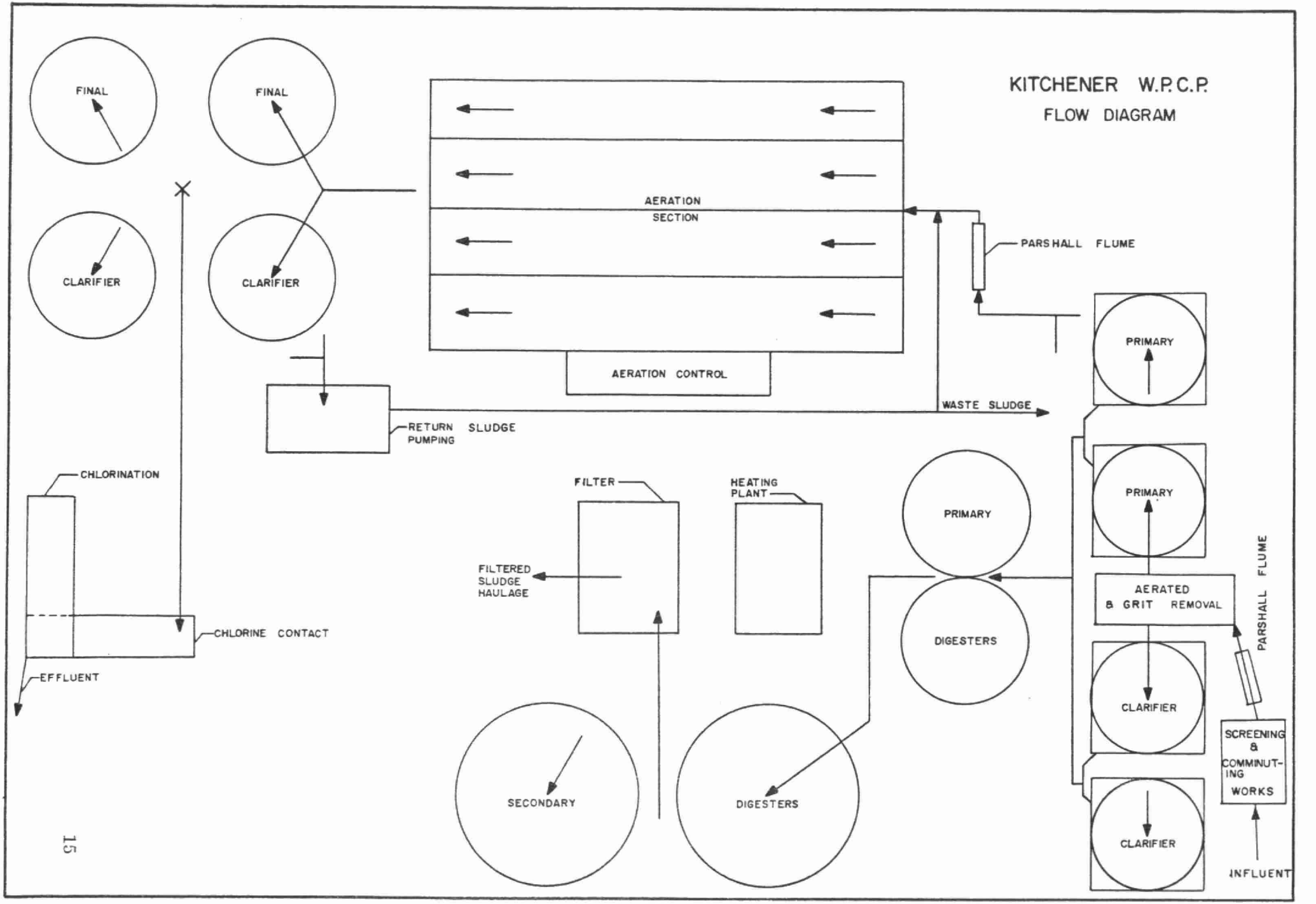
1965 OPERATING COSTS



TOTAL ANNUAL COST



Technical Section


KITCHENER W.P.C.P.
FLOW DIAGRAM
FINAL
FINAL
CLARIFIER
CLARIFIER
AERATION
SECTION
AERATION CONTROL
PARSHALL FLUME
PRIMARY
WASTE SLUDGE
RETURN SLUDGE
PUMPING
CHLORINATION
CHLORINE CONTACT
EFFLUENT
FILTER
HEATING
PLANT
FILTERED
SLUDGE
HAULAGE
PRIMARY
PRIMARY
AERATED
& GRIT REMOVAL
DIGESTERS
PARSHALL FLUME
CLARIFIER
SCREENING
&
COMMINUT-
ING
WORKS
SECONDARY
DIGESTERS
CLARIFIER
INFLUENT

Design-Data

GENERAL

Type of Plant - Activated sludge.

Design Population - 100,000 persons.

Design Plant Flow - 11.0 MGD (prim.)
13.5 MGD (sec.)

Five Day BOD -

Raw Sewage	-	300 PPM
Removal	-	95%

Suspended Solids -

Raw Sewage	-	450 PPM
Removal	-	95%

PRIMARY TREATMENT

Screening and Comminution

Coarse bar screens.

Two Infilco rotogrators.

One Worthington comminutor.

Grit Removal

Type - Two air degrittors.

Size - 16 ft. x 10 ft. x 12 ft. SWD.

Volume - 23,000 gallons.

Fine Screening

Type - Two Dorr-Oliver-Long rotary screens.

Primary Sedimentation

Type - Four square concrete tanks.

Size - 60 ft. x 60 ft. x 11.75 SWD.

Retention time - 2.2 hours.

Sludge Removal - Mechanical.

SECONDARY TREATMENT

Aeration

Ames Crosta mechanical aerators - 56.

Size - Four tanks, 30 ft. x 30 ft. x 13 ft. 3 in. with "around the end" baffles, each tank being two cells in width and seven cells in length.

Retention - 7 hours at 13.5 MGD.

Final Sedimentation Tanks

Type - Circular concrete (four).

Size - 80 ft. diameter and 10 ft. SWD.

Retention - 2.4 hours at 13.5 MGD.

Chlorine Contact Chamber

Retention - 15 minutes at 13.5 MGD.

Equipment - Two B.I.F. gas chlorinators and one evaporator.

Digestion System

Two Primary Digesters Underground -

Size - 65 ft. diameter x 22 ft. SWD.

Volume - 900,000 gallons.

Fixed covers, mechanical mixing.

Two Secondary Digesters -

Size - 100 ft. diameter x 29 ft. SWD.

Volume - 2.5 million gallons.

Floating covers for gas storage.

Vacuum Filter

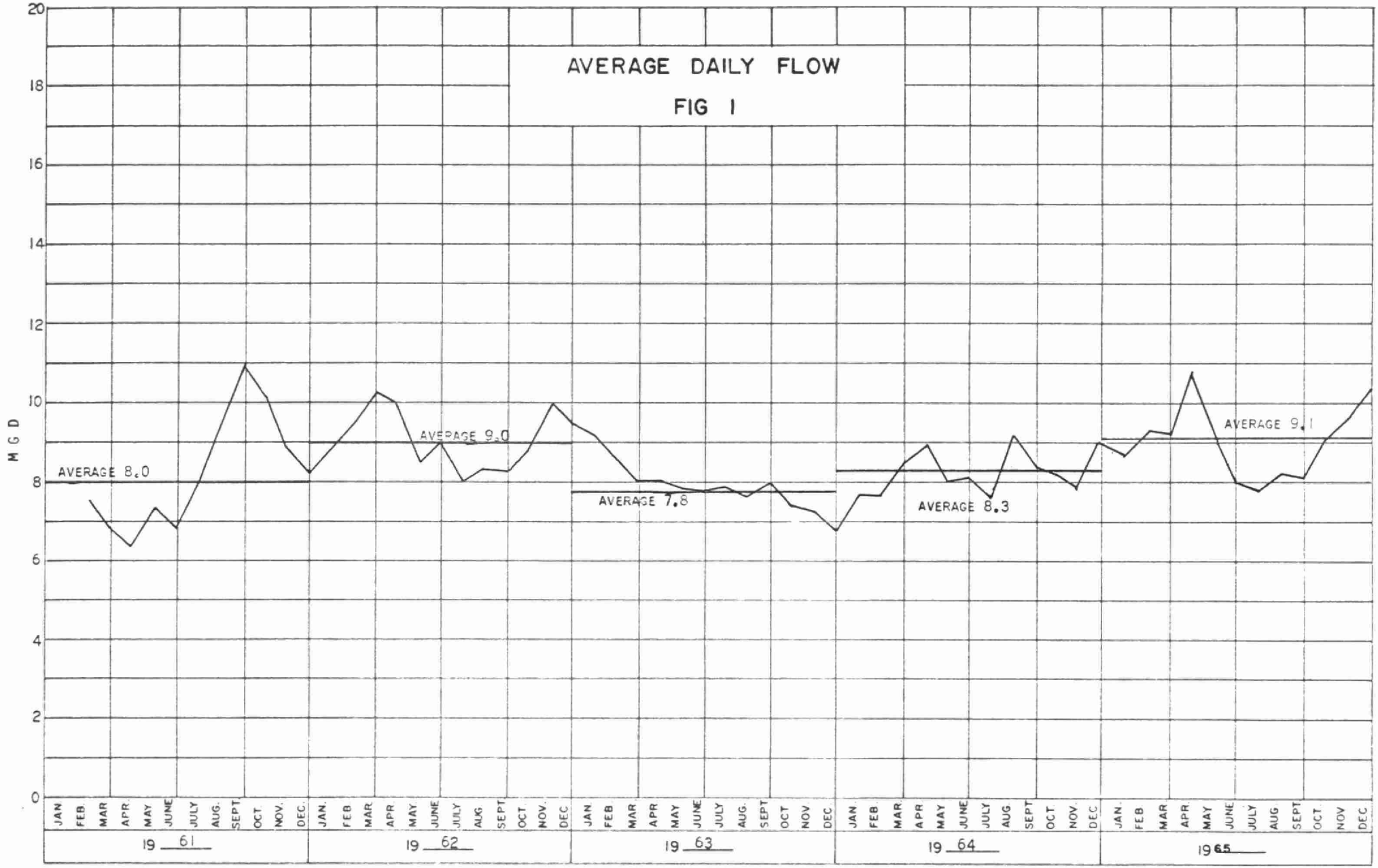
One Komline-Sanderson coil filter with 500 sq. ft. surface area.

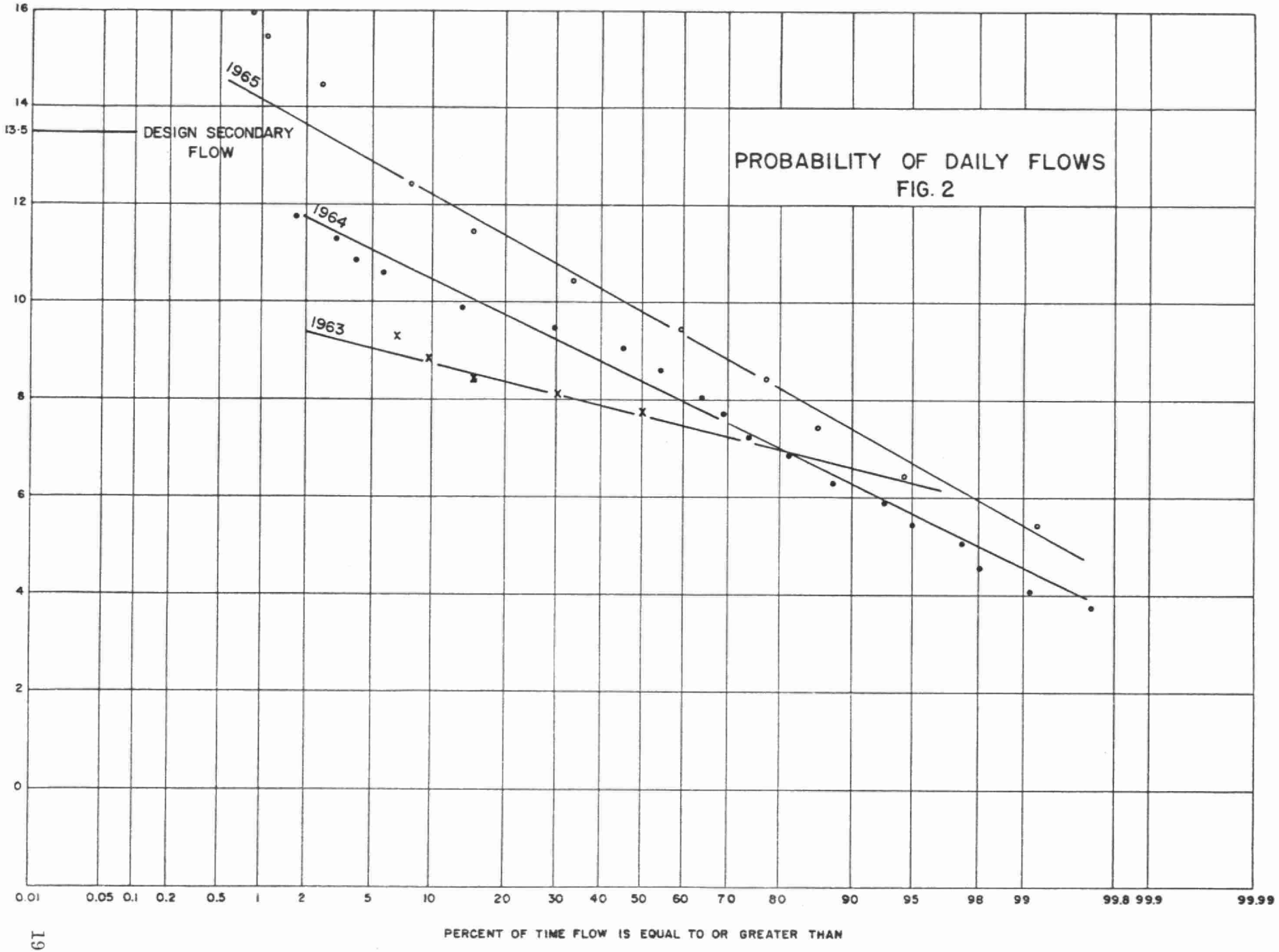
Process Data

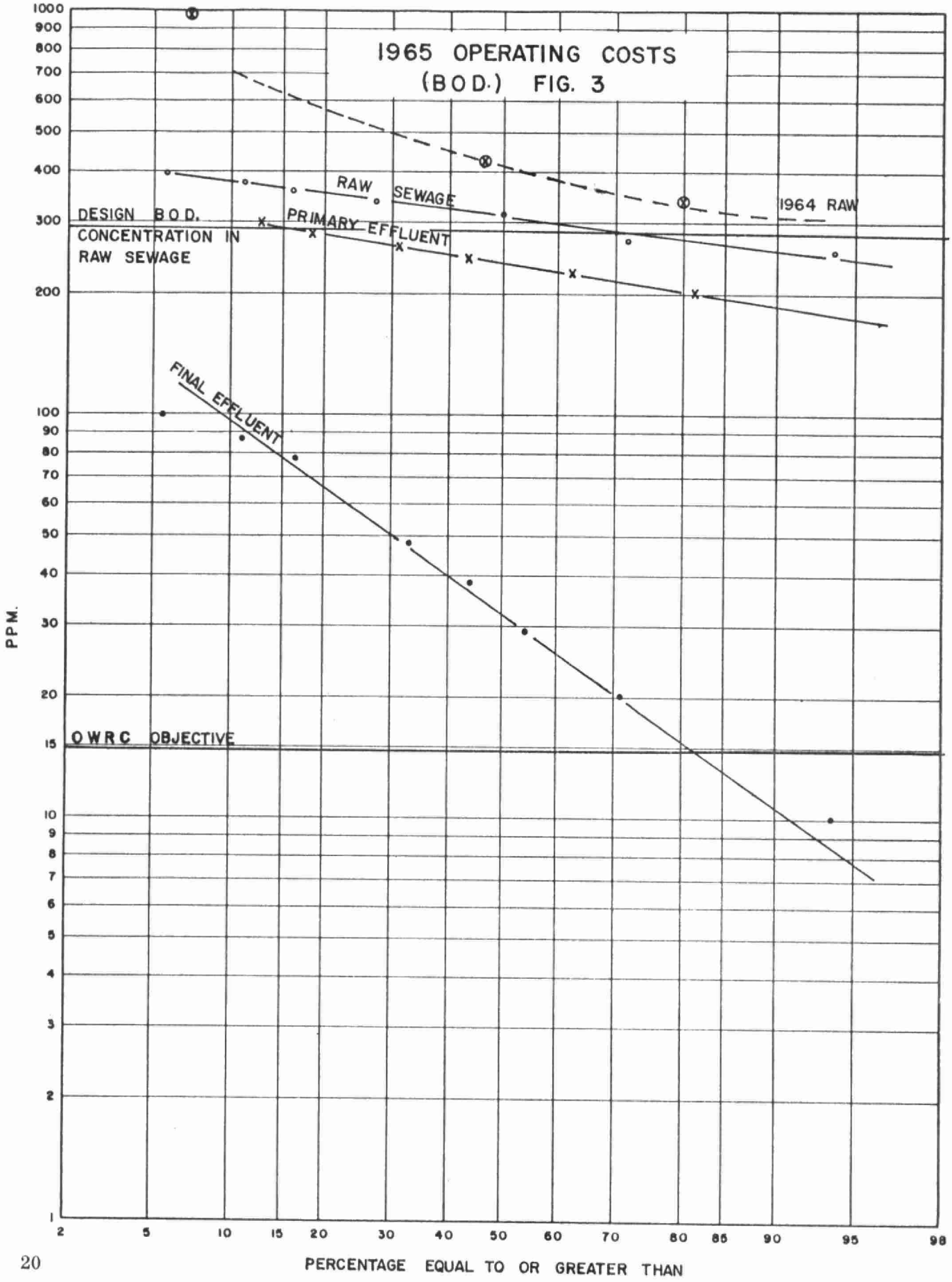
The total daily flows averaged by month for the period of February 1961 to December 1965 are shown on Figure No. 1. The average daily flow for 1965 of 9.1 mgd increased 9.6 percent as compared to the average daily flow of 8.2 mgd in 1964. During the past year, 3,228 million gallons of raw sewage composed of both domestic and industrial wastes received complete treatment.

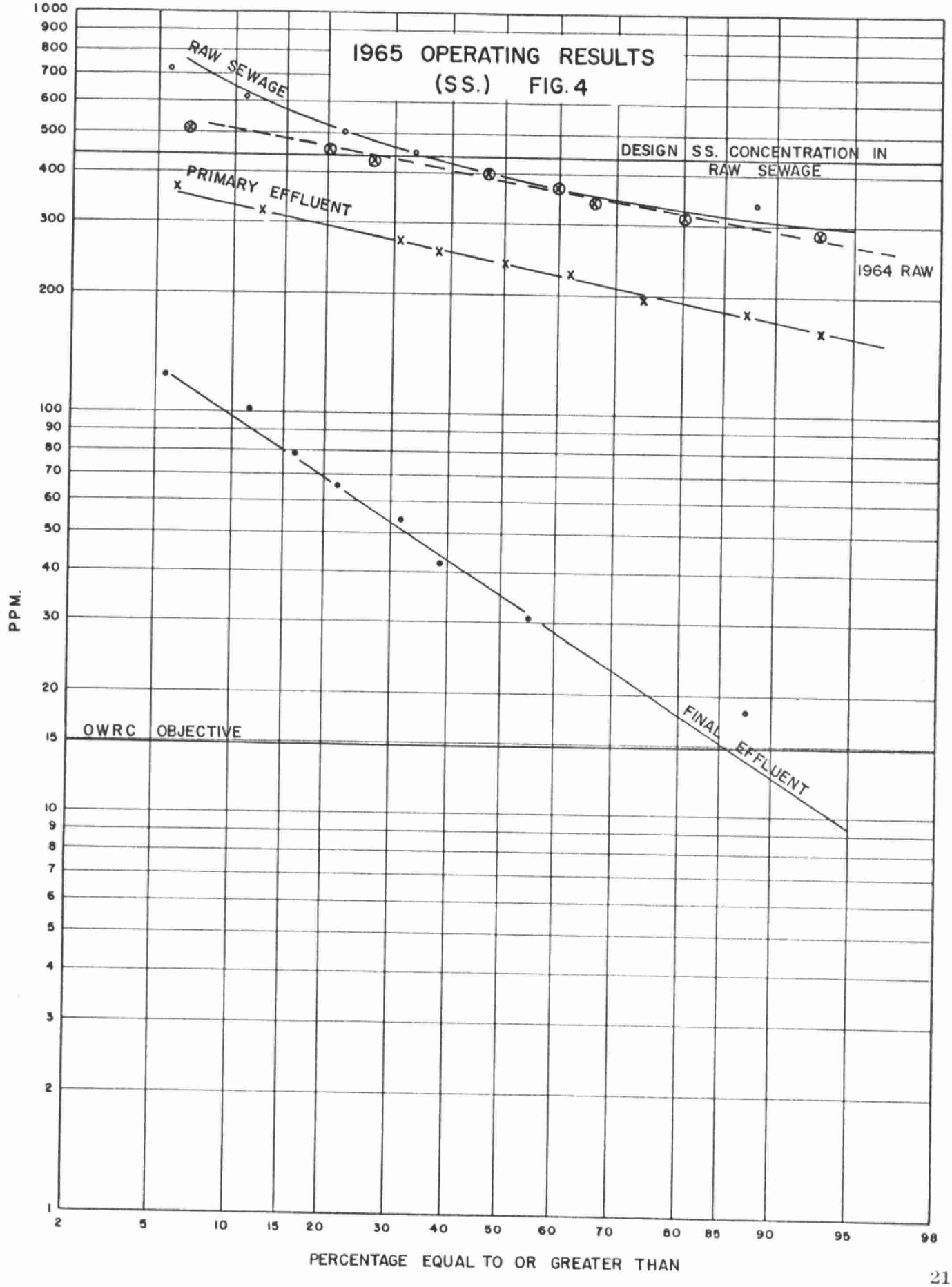
The maximum total daily flow averaged by month was 10.3 mgd and occurred in December. The average daily flow for the year of 9.1 mgd was exceeded, averaged on a monthly basis during the months of January, February, March, April, November and December.

There are four aeration tanks with a design flow of 13.5 mgd. However, because of electric power supply limitations only 75 percent of the aeration section can be utilized. As a result the design flow for the aeration section portion that can be utilized is 10.1 mgd. The flow exceeded the design primary and aeration section values of 11.0 mgd and 10.1 mgd, 27 percent and 45 percent of the time respectively. Probability flow curves for 1963, 1964 and 1965 are illustrated on Figure No. 2.


AVERAGE DAILY FLOW
FIG 1
M G D
20
18
16
14
12
10
8
6
4
2
0
AVERAGE 8.0
AVERAGE 9.0
AVERAGE 7.8
AVERAGE 8.3
AVERAGE 9.1
JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT NOV. DEC.
19 61
19 62
19 63
19 64
1965


PROBABILITY OF DAILY FLOWS
FIG. 2
DESIGN SECONDARY FLOW
13.5
1965
1964
1963
MILLION GALLONS PER DAY
16
14
12
10
8
6
4
2
0
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN


1965 OPERATING COSTS
(B O D.) FIG. 3
RAW SEWAGE
1964 RAW
DESIGN B O D.
CONCENTRATION IN
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
O W R C OBJECTIVE
PPM.
PERCENTAGE EQUAL TO OR GREATER THAN


1965 OPERATING RESULTS
(SS.) FIG. 4
RAW SEWAGE
DESIGN SS. CONCENTRATION IN RAW SEWAGE
PRIMARY EFFLUENT
1964 RAW
OWRC OBJECTIVE
FINAL EFFLUENT
PPM.
PERCENTAGE EQUAL TO OR GREATER THAN
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
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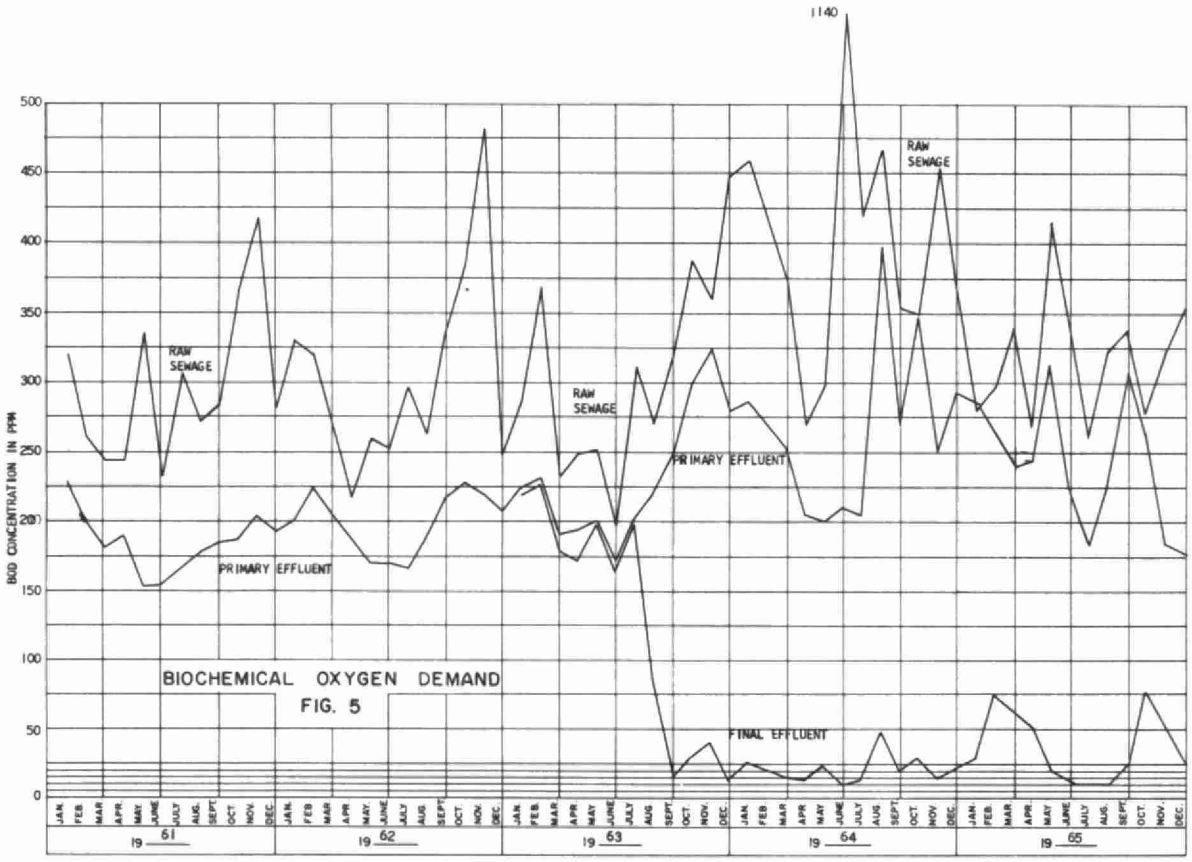
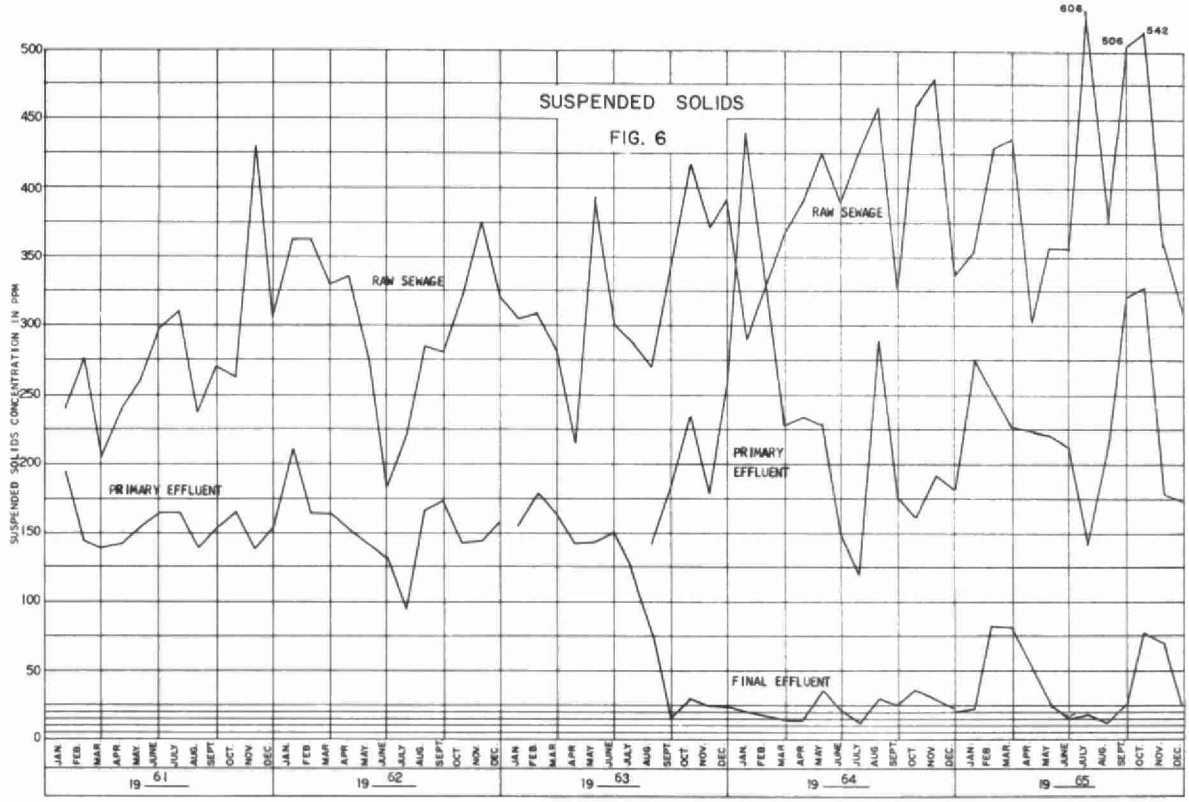
30
40
50
60
70
80
85
90
95
98



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	282	28	90.0	346.1	356	22	94.0	455.1	469
FEB.	300	76	74.5	294.4	432	82	81.0	460.0	1176
MAR.	342	64	81.0	401.5	440	82	81.5	517.1	1015
APR.	270	52	80.5	354.5	304	53	82.5	408.2	630
MAY	420	20	95.0	571.1	360	26	92.5	476.8	553
JUNE	345	14	96.0	405.8	360	16	95.5	421.7	784
JULY	260	10	96.0	303.9	606	18	97.0	720.6	525
AUG.	325	10	97.0	415.0	379	13	96.5	476.4	616
SEPT.	340	22	93.5	391.6	506	25	95.0	592.4	598
OCT.	285	77	73.0	298.1	542	77	85.5	666.5	700
NOV.	325	53	83.5	394.4	362	71	80.5	422.0	679
DEC.	352	28	92.0	517.6	359	24	93.5	535.2	588
TOTAL	-	-	-	4692.6	-	-	-	6240.2	8333
AVG.	320	38	88.0	391.0	417	42	90.0	520.0	694

COMMENTS

The BOD and suspended solids concentrations and removals are based upon eight hour composite samples collected at regular weekly intervals. The BOD and suspended solids concentrations of the raw sewage, primary effluent and final effluent are presented on probability plots in figures No. 3 and 4 respectively. The influent, primary effluent and final effluent BOD and suspended solids averaged for the month are plotted on an arithmetic basis on figures No. 5 and 6 respectively.

The average BOD concentration of 320 ppm exceeded the design concentration of 300 ppm by 6 percent. Figure No. 3 indicates that the raw sewage BOD concentration exceeded the plant design figure 70 percent of the time. This is a reduction from 1964 when the raw sewage BOD concentration exceeded the plant design figure 95 percent of the time. A total of 4,693

tons of BOD was removed in 1965. The average WPCP BOD reduction efficiency was 88.1 percent.

The average final effluent BOD of 28 ppm exceeded the OWRC objective of 15 ppm. The final effluent BOD concentration exceeded this objective 83 percent of the time.

The average suspended solids concentration of 417 ppm is 92.8 percent of the design concentration of 450 ppm. Inspection of Figure No. 4 indicates that the raw sewage suspended solids concentration exceeded the plant design figure 26 percent of the time. A total of 6,240 tons of suspended solids were removed in 1965. The average suspended solids reduction efficiency was 90 percent.

The average final effluent suspended solids of 42 ppm exceeded the OWRC objective of 15 ppm. The final effluent suspended solids exceeded this objective 86 percent of the time.

A total of 8333 cubic feet of grit was removed during the year. This is equivalent to 2.50 cubic feet per million gallons of sewage treated.

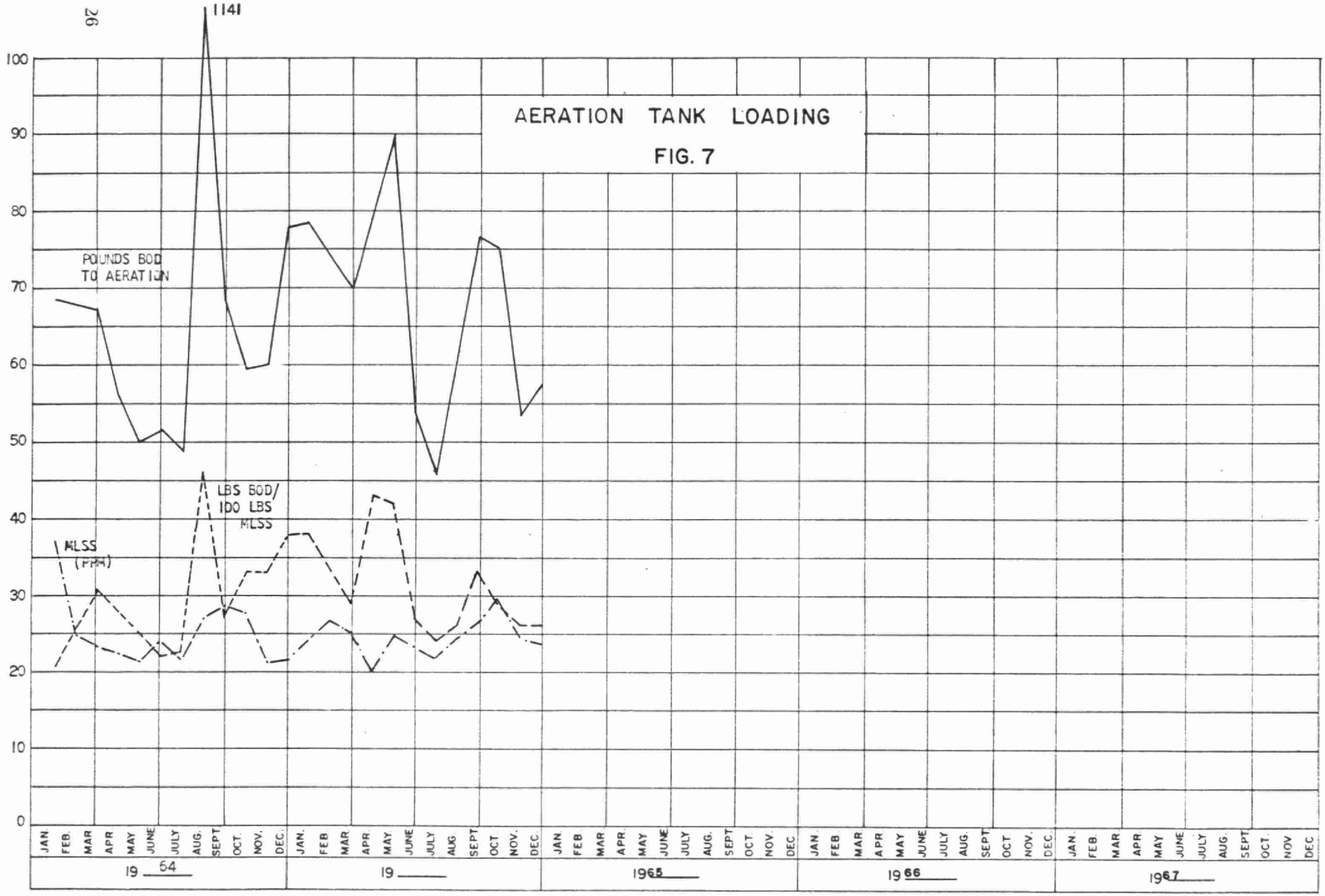
CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	272.54	8160	2.99
FEBRUARY	262.88	10814	4.11
MARCH	288.87	13995	4.84
APRIL	325.22	12235	3.76
MAY	285.53	10485	3.67
JUNE	245.18	8695	3.55
JULY	245.10	8690	3.54
AUGUST	260.31	* 3595	2.85
SEPTEMBER	246.32	11560	4.69
OCTOBER	286.65	14660	5.11
NOVEMBER	290.00	16360	5.64
DECEMBER	319.50	12145	3.801
TOTAL	3328.10	131394	-
AVERAGE	27.734	10950	4.11

* 15 days chlorination

COMMENTS

An average chlorine dosage rate of 4.11 ppm was required to maintain a residual of 0.5 ppm after 15 minutes contact time.

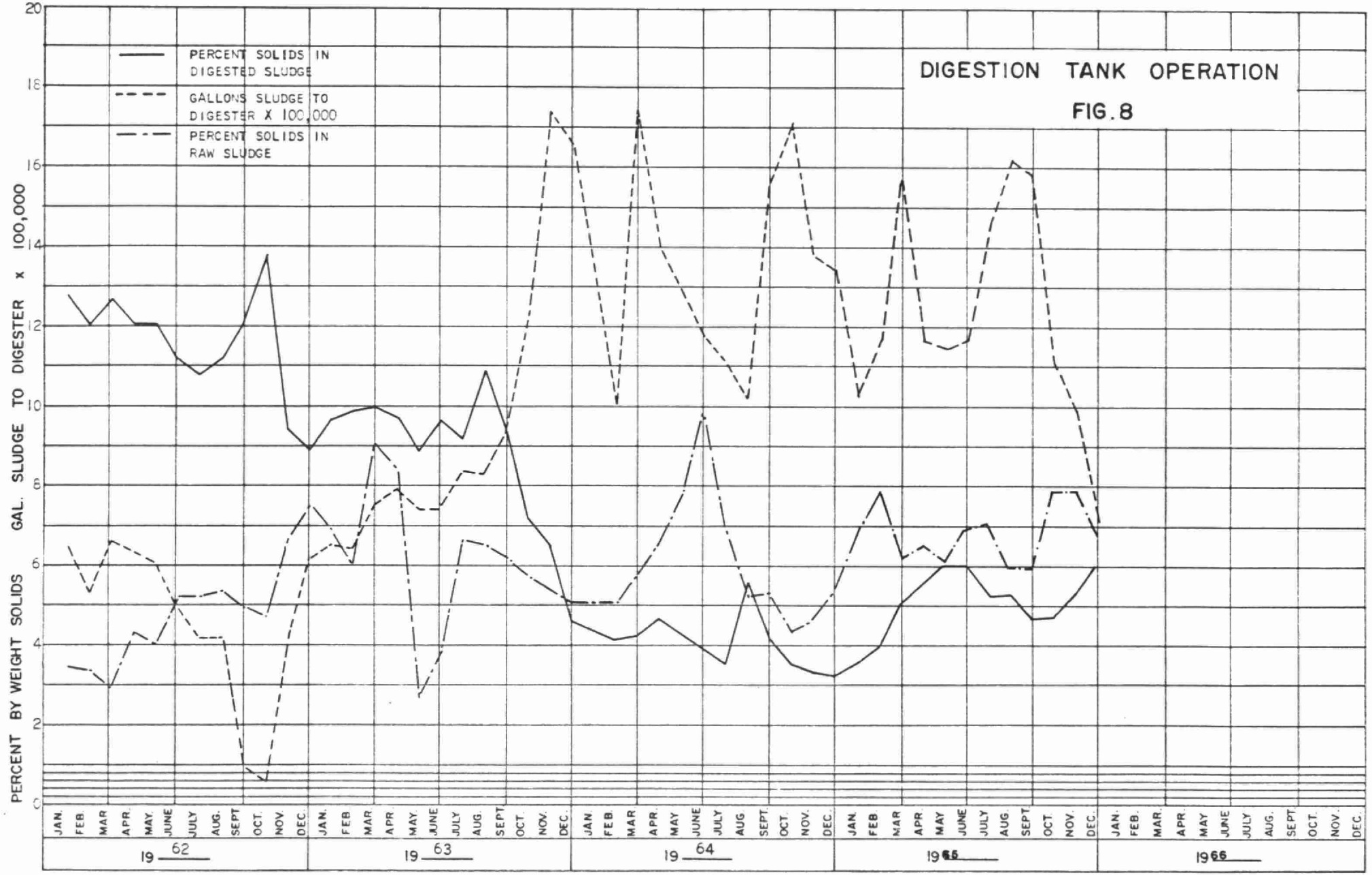

1141
AERATION TANK LOADING
FIG. 7
POUNDS BOD TO AERATION
LBS BOD/ 100 LBS MLSS
MLSS (7?4)
100
90
80
70
60
50
40
30
20
10
0
JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 64
19 ____
1965
1966
1967

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	288	2401	38	-
FEBRUARY	-	2690	-	-
MARCH	242	2516	29	-
APRIL	245	2062	43	-
MAY	315	2476	42	-
JUNE	220	2326	27	-
JULY	185	2199	24	-
AUGUST	232	2421	26	-
SEPTEMBER	310	2612	33	-
OCTOBER	262	2931	28	-
NOVEMBER	185	2468	26	-
DECEMBER	180	2372	26	-
TOTAL	-	-	-	-
AVERAGE	242	2456	31	-

COMMENTS

The average MLSS concentration of 2,456 ppm and the average pounds of BOD per 100 pounds MLSS ratio of 31 are both within the accepted limits of good aeration section operation. The pounds of BOD to the aeration section, MLSS concentrations and pounds of BOD per 100 pounds MLSS averaged on a monthly basis for the year are plotted on Figure No. 7.

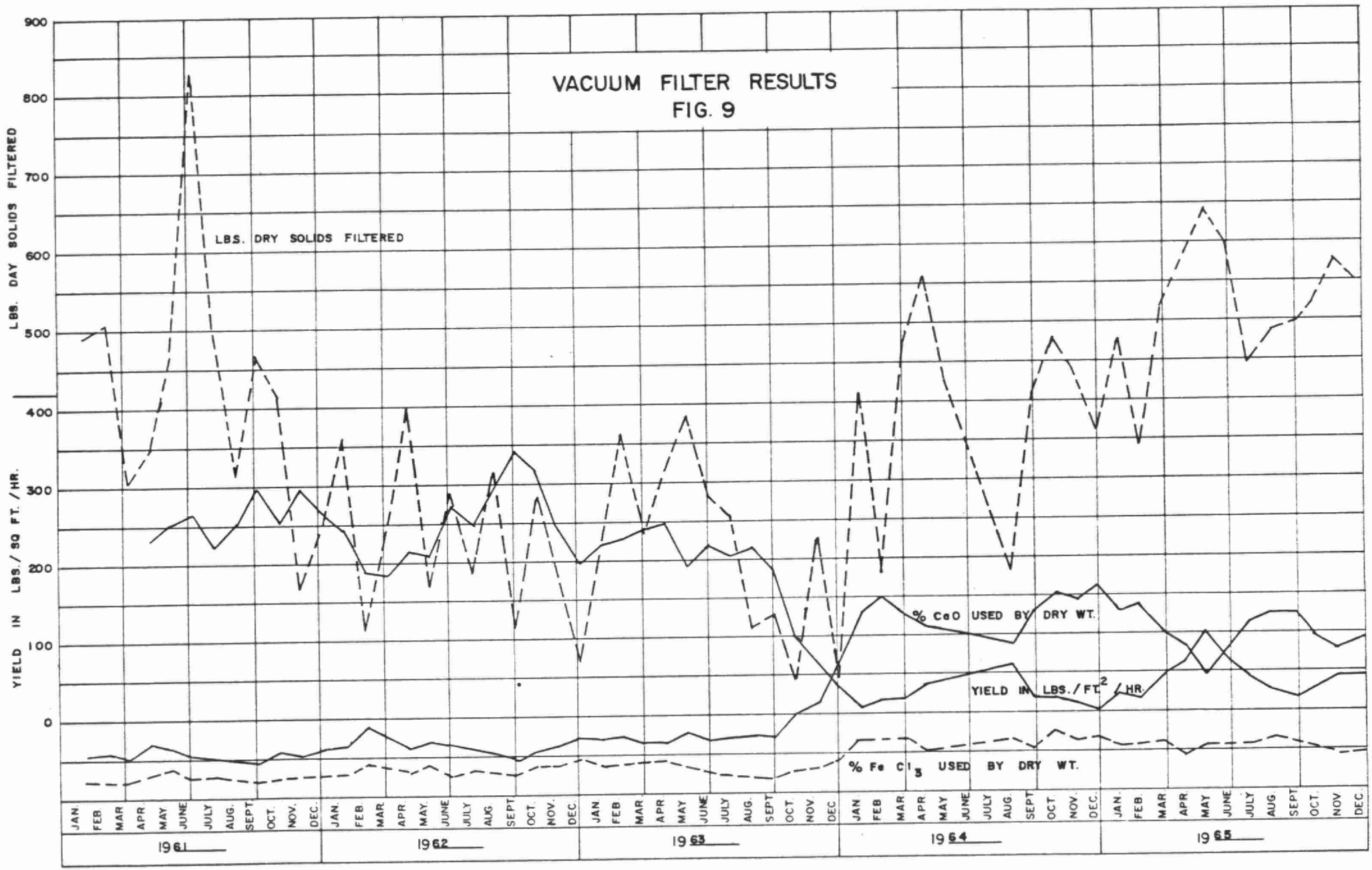

DIGESTION TANK OPERATION
FIG. 8
PERCENT SOLIDS IN DIGESTED SLUDGE
GALLONS SLUDGE TO DIGESTER X 100,000
PERCENT SOLIDS IN RAW SLUDGE
PERCENT BY WEIGHT SOLIDS GAL. SLUDGE TO DIGESTER x 100,000
0
2
4
6
8
10
12
14
16
18
20
JAN. FEB. MAR APR. MAY. JUNE JULY AUG. SEPT OCT. NOV DEC.
19 62
19 63
19 64
19 65
19 66

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU FT.	% SOLIDS	% VOL. MAT.	1000'S CU. FT.	% SOLIDS	% VOL. MAT	
JAN.	164.01	6.88	4.92	121.35	3.54	2.07	-
FEB.	187.72	6.15	4.09	192.18	3.93	2.22	-
MAR.	257.84	6.18	4.42	269.90	5.09	2.56	-
APR.	186.86	6.42	4.35	191.12	5.55	2.97	-
MAY	183.91	6.10	4.56	189.05	6.12	3.14	-
JUNE	188.54	6.92	4.99	157.64	6.07	3.17	-
JULY	232.31	7.04	4.81	240.66	5.26	2.88	-
AUG.	259.98	5.96	4.34	282.88	5.34	2.85	-
SEPT.	255.83	5.97	4.17	161.91	4.74	2.48	-
OCT.	179.39	7.93	5.69	186.04	4.75	2.62	-
NOV.	159.66	7.95	5.20	173.13	5.36	2.82	-
DEC.	115.94	6.64	3.34	140.82	6.07	3.15	-
TOTAL	2,371.99	-	-	2,306.68	-	-	-
AVG.	197.67	6.68	4.57	192.22	5.15	2.74	-

COMMENTS

From the information obtained, an average of 197,670 cubic feet of sludge per month was pumped to the primary digesters. The sludge contained an average of 6.68 percent total solids of which 68.5 percent was volatile matter. Sludge from the primary digesters contained an average of 5.15 percent solids of which 53.2 percent was volatile matter. The volatile matter was reduced by an average of 47.7 percent which compared favourably with the established criteria. Raw sludge solids expressed as percent by weight and averaged on a monthly basis are plotted on figure no. 8 along with the gallons of sludge per month pumped to the digesters.


VACUUM FILTER RESULTS
FIG. 9
LBS. DAY SOLIDS FILTERED
900
800
700
600
500
400
300
200
100
0
LBS. DRY SOLIDS FILTERED
% CaO USED BY DRY WT.
YIELD IN LBS./FT.² / HR.
% Fe Cl₃ USED BY DRY WT.
YIELD IN LBS./ SQ FT. / HR.
JAN. FEB MAR APR. MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
1961
1962
1963
1964
1965

VACUUM FILTER OPERATION

MONTH	FILTER HOURS		% SOLIDS DIGEST SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME	% LIME	LBS. $FeCl_3$	% $FeCl_3$	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
	#1	#2								
JAN.	379.5	-	3.78	457700	105480	23.0	26196	5.72	19.0	2.42
FEB.	287.5	-	3.95	340100	81090	23.8	20006	5.88	20.0	2.38
MAR.	366.0	-	4.96	523900	105445	20.2	31106	5.94	20.1	2.86
APR.	360.0	-	5.57	583900	107275	18.4	25732	4.41	21.3	3.24
MAY.	323.5	-	6.11	645100	95230	14.7	34862	5.40	21.3	4.00
JUNE	364.0	-	6.08	602400	107800	17.9	31870	5.29	20.9	3.37
JULY	311.0	-	5.69	447700	95470	21.3	25215	5.63	19.7	2.88
AUG.	376.5	-	5.20	485900	108925	22.4	30615	6.30	19.8	2.59
SEPT.	405.5	-	4.70	499600	111890	22.4	30319	6.07	19.7	2.46
OCT.	396.5	-	4.77	526500	102565	19.4	27096	5.15	20.6	2.67
NOV.	402.0	-	5.80	581000	105000	18.1	26513	4.56	20.5	2.90
DEC.	375.5	-	5.96	554500	106040	19.1	25842	4.66	21.0	2.93
TOTAL	4347.5	-	-	6248300	1232210	-	335372	-	-	-
AVG.	362.3	-	5.21	520692	102684	19.7	27948	5.37	20.3	2.89

COMMENTS

The average filter yield of 2.89 pounds per square foot is in the lower range of anticipated yields with a combination of digested primary and activated sludge. Vacuum filtration increased the average percent solids from 5.21 percent to 20.3 percent. Pounds of dry solids filtered per month, filter yield averaged on a monthly basis and percent filter chemicals used averaged on a monthly basis are plotted on Figure No. 9.

CONCLUSIONS

The average BOD and suspended solids removals were 88.0 percent and 90.0 percent respectively. Throughout the year the plant staff operated a clean, attractive and efficient plant for the City of Kitchener.

RECOMMENDATIONS

Difficulties have been encountered during certain periods in obtaining an adequate water supply and a potable water of good quality. It is therefore recommended that steps be taken to renovate the existing plant water system.

The average BOD and suspended solids concentration in the effluent exceeded the OWRC objectives. During the year, only 75 percent of the aeration section could be utilized due to power limitations. As a result, combined with heavy loadings the water pollution control plant was unable to attain the efficiency normally associated with the activated sludge process. It is recommended that electric power be supplied by the Kitchener Public Utilities Commission to eliminate the present power limitations, so that the entire aeration section can be placed in operation.


ONTARIO WATER RESOURCES COMMISSION